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ABSTRACT

Intended for use by senior high school students, teachers, and guidance counselors, this document is designed to serve as a reference to those individuals seeking more information on the education and work required in various marine careers. Marine careers are classified into three broad groups: (1) fully qualified professionals, (2) partially qualified assistants, and (3) support personnel. These groups are distinguished by level of training or education and amount of responsibility in marine science work. Detailed examinations at many careers in each of the three groups is presented, along with employment trends in these areas. Training and education needed for employment in these careers is given. An annotated bibliography of both publications and films related to marine career education is included. Even though this publication has some focus on the New York City area, it should be useful to other localities. (MR)

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OCEAN CAREERS: A Survey of Opportunities and Requirements

by

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INTRODUCTION

The National Academy of Sciences has defined oceanography as "the scientific study of all aspects of the oceans, their boundaries and their contents." Considering the scope of our marine science resources, it is no wonder that oceanography has, in fact, become a conglomerate of efforts taking in all interests which have any bearing on the seas.

An attempt will be made in this report to describe some careers in oceanography. Major sources of information for the report are books by Boyd, Gaber, Long, and Poss. In addition, Chronical Guidance Publications, the Encyclopedia of Careers and Vocational Guidance, and the Occupational Handbook were consulted. These and other references will be found in the annotated bibliography at the end of this paper. The descriptions will usually include the nature of the work, the requirements and the salary and employment outlook. Whenever possible, additional information is given. The annotated bibliography will serve to help those who need answers to specific questions.

The Interagency Committee on Oceanography has categorized careers in oceanography in the following way:

TYPES OF CAREERS

Group I Careers

Those fully qualified for professional work in one or more branches of marine sciences:

- (a) Oceanographers (biological, chemical, physical, geological, fisheries, etc.) with training or experience equivalent to a Masters degree or higher in specialized fields of oceanography;
- (b) Fisheries (Management) specialists with training or experience in management of ocean fishery resources equivalent to a Masters degree or higher;
- (c) Oceanographic engineers with training or experience in applied research in the oceanic environment equivalent to a Masters degree or higher.

Group II Careers

Those who are engaged in scientific or technical work in marine science, but who are not fully qualified to perform independent professional work in this field:

- (a) Technicians (with fields of specializations similar to those of oceanographers and fishery specialists) with training or experience equivalent to a Bachelors degree or less;
- (b) Interns with no specialized training or extensive experience in oceanography or fisheries. On-the-job training of less than five years. They are potential oceanographers, fishery specialists or oceanographic engineers;
- (c) Students at the graduate level employed in oceanographic research and taking marine science courses;
- (d) Non-oceanographic engineers or technicians with little training or experience in the marine science specialities, but employed in oceanographic research or engineering. Some

may have a graduate degree in another field.

Group III Careers

This is a group not mentioned by the Interagency Committee on Oceanography but includes those who function as service personnel. This group transforms the ideas of the scientists into goods and services:

- (a) Boat builders and repair workers build and repair boats of all types, for all purposes.
- (b) Sales personnel include everyone involved in the sale and distribution of marine products.
- (c) Construction and maintenance of mining and petroleum equipment, piers, breakwaters, harbors, channels, power plants, and energy installations.
- (d) Port, harbor and inland maritime personnel.
- (e) Commercial fishing, including fishing captains, deckhands, cooks, engineers, fish handlers and processors.

General Overview

Nowadays, in order to be a research oceanographer requires a doctoral degree if one wishes to gain employment and receive recognition.

Oceanography is often broken down into physical, geological, chemical and biological specialities. However, the lines that separate these disciplines have become less important and a good oceanographer will have a competent background in the other disciplines in order to understand his/her own specialty more comprehensively.

Normally, oceanography is taught at the postgraduate level for students with a good background in science and mathematics. There are some colleges and an increasing number of high schools which offer a few introductory courses in the marine sciences.

To be a good oceanographer requires at least a Masters degree, (preferably a doctoral degree) either in oceanography or one of the component basic sciences such as chemistry, physics, geology, or biology.

Mathematicians are needed in all branches of oceanography.

Engineers who at one time fared well with bachelors level training are now feeling the pressure to move on to the more advanced degrees.

Administrators and others concerned with sales will probably do well with an appropriate Bachelor's degree.

Technicians normally attend two-year colleges and often receive an Associates degree in Ocean Science. Technicians are extremely important and are needed in all fields of oceanography, including operations at sea, instrumentation, maintenance and repair, and data processing.

Fisheries science is a branch of marine biology which is becoming more important as world food shortages increase.

Fishers (fishermen) have always been important to the economy of coastal nations. Marine engines, navigation equipment, and fishing gear are becoming more complex. Therefore, school training is desirable for these jobs.

Those who love the sea but who wish to delay formal schooling may still find a spot in oceanography. There are many unspecialized occupations such as ordinary seaman, deck hand, painter, oiler, mess attendant, etc. available to willing workers.

Currently, comparatively few jobs are available in oceanography, but the demand is likely to grow, slowly but steadily. Opportunities depend on the amount the federal government will spend on research on this science and the growing awareness of the importance of oceanography by the private sector.

As the number of scientists engaged in research oceanography increases, so will the number of technicians, crew members and others who will help them in their work.

The following pages contain information pertaining to the careers previously mentioned.

Detailed Examination of Some Group I Careers

(a) The Oceanographer

- (1) Description: Although some oceanographers carry on a great variety of activities, we will concentrate on the four general specialities;

Physical: The study of tides, waves, currents, temperatures, ice conditions, sound transmission;

Geological: The study of the ocean bottom, its origin and shape, its sediments, and rock formations of the ocean crust.

Biological: The study of the plant and animal life in the sea and their ecology (the way they depend upon one another and on their environment);

Chemical: The study of the chemical processes operating within the ocean, the sea floor and the marine atmosphere;

Some oceanographers work on shore, but most spend at least a portion of their time at sea in floating labs and research ships; others may work far below the surface in submarines, or use aqualungs to swim at shallow depths. Most spend a good deal of time at sea us-

ing instruments to collect data.

Some oceanographers use airplanes to observe the ocean surface, to direct activities of surface vessels and to gather information about the relationship between the ocean and weather. Satellite photos are also very useful in studies of currents, waves, sea-ice and ocean life.

Some oceanographers work along the water's edge and gather information about sea level, tides, and storm effects on beaches and shallow-water creatures.

As time goes on, more and more information can be processed by computers but the oceanographers must plan activities, record details of experiments and expeditions, develop and test theories that explain facts collected, write scholarly reports so that other scientists may know what they are doing and defend their theories and conclusions against criticism.

Depending on the kind of work an oceanographer does he/she may work regular hours in an office or laboratory. They may also join expeditions that last many weeks to many months.

(2) Earnings: As of the mid-1970's, beginning oceanographers in civil service positions with the federal government started at around \$8,000 or \$9,500 per year with a Bachelor's degree; those with a Masters degree started at about \$12,000 or \$17,000. Supervisory or administrative positions requiring experience in the

field ranged from \$12,000 to \$20,000. College teaching positions depending on rank and experience, covered the same salary range as other faculty members. In addition to regular salaries, oceanographers may supplement their incomes with fees earned from consulting, lecturing and writing.

(3) Requirements:

- (1) High School: An academic course should be pursued. As much mathematics and science as possible should be taken.
- (2) College: The minimum requirement for beginning professional jobs in oceanography is a Bachelor's degree with a major in oceanography, biology, earth or physical science, chemistry, geology, mathematics, or engineering.

Several universities now give a Bachelor's degree in oceanography. The National Oceanic and Atmospheric Administration has available a list of schools offering marine programs.

For better jobs, one must move up to the Doctoral level. The more experienced oceanographers direct surveys and research programs or advance to administrative or supervisory jobs in research laboratories.

- (4) Employment Outlook: Things will be very competitive through the 1980's. Those with a Ph.D. degree should have more favorable employment opportunities than others, while those with less education may find opportunities limited to routine analytical work as research assistants or technicians. As mentioned earlier,

growth in the field depends much on the awareness of the problems and solutions offered by the sea and funding available from the federal government.

(b) Fisheries Scientists (Fish Culturists)

- (1) Description: As a source of food, pharmaceutical raw materials and as recreation, fishing has enormous possibilities for our expanding population. Fisheries research and management, out in the deep ocean and along the extensive inland waters, still in their infancy.

The emphasis today is on research, management, and education-research to develop methods of managing various freshwater and saltwater resources for maximum sustainable and/or economic yields of either fish or fishing; management to put into practice what has been learned from research; and education to inform the fishermen and the public of problems involved and progress made.

Fisheries jobs for both men and women at the professional level include:

Fisheries Research: Researchers study the total environment of fish. They study life history, habit and physiology. They analyze catches and fish populations.

All disciplines of science are used by fisheries scientists in doing experiments. The major goal is to provide information useful in maintaining existing stocks of fish or to produce more fish for food and recreation.

Fisheries Management: Many more professionally trained fish managers have been hired as time goes on to carry out programs designed to supplement, maintain or restore fish populations for recreational or commercial purposes. The manager is concerned with population controls, catch estimates, pollution and environmental control, reclamation of fishing waters, and any other work having to do with managing both natural and artificial fish productions.

Fish Culture: Culturists operate hatcheries, fish farms, and do some work dealing with conservation and management of aquatic resources.

Fisheries Administration: The administrator plans and coordinates the fisheries research and development programs, establishes policies and regulations, and sees that the regulations are enforced. He coordinates research findings with the work at hand and carries on effective public relations work.

Fisheries Teaching: More than 100 universities and colleges in the U.S. and Canada now have courses in fisheries science for which teachers are needed, although the turnover is slow. University training to the Ph.D. level is required, along with broad practical experience.

Educational Writers: Knowledge of fisheries, biology, and writing ability are required. Both the public and coworkers must be informed on progress in the field. Photography and

drawings supplement writing.

- (2) Earnings: In 1972, the salary range went from \$7,000 to nearly \$40,000 for a top administrative position.
- (3) Requirements: As in oceanography, a good background in science and math at the high school level is essential.

Federal fisheries research positions require a minimum of of at least 30 semester hours of college courses; in biology, and aquatic sciences, and 15 semester hours in physical and mathematical sciences. Of these 45 hours:

- 15 must be in zoology;
- 6 must be in courses like limnology, fisheries biology, fish culture, aquatic biology or equivalent study in the field.

Needless to say, the higher the degree, the better the chance of landing a job.

- (4) Future: The field is very young and very small, but is growing steadily. It offers variety and challenge because it is a fairly new field. Commercial fisheries interests see an expanding future for fish farming and harvesting techniques, especially in underdeveloped countries of the world.

Other occupations in Group I include:

- Marine Bacteriologist
- Aquaculturists
- Biochemists
- Physiologists

- Marine Physicists
- Geographers
- Cartographers
- Meteorologists
- Ecologists
- Computer programmers
- Statisticians
- Coastal Management
- Environmental Planners & Regulators
- Engineers of every kind
- Educators

Detailed Examination of Some Group II Careers

(a) Oceanographic Technician

- (1) Description: This is a broad field and actually describes people performing a number of occupational functions related to marine activities such as:

- Mapping and charting the oceans
- Aquaculture
- Geophysics
- Weather service

- (2) Requirements: The qualifications for oceanographic technician are as follows:

Good background in mathematics, especially mathematics needed to make use of scientific and engineering principles.

Basic physics and chemistry as it pertains to the particular fields of technology.

Communication skills, including the ability to interpret, analyze and transmit facts and ideas graphically, orally, and in writing.

An Associate degree from a two-year institution in a particular area of oceanographic technology is very helpful.

- (3) Earnings: Earnings vary depending on the job and locations, whether you are based on land or at sea and the hazards involved in the job.
- (4) Future Outlook: Prospects for the future, as with the other fields of oceanography, vary with what the government is willing to sponsor and awareness of the importance of the marine science. In general, things should pick up slowly and rather steadily.

(b) Fish Culture Technicians

- (1) Description: There are three main subdivisions under the heading fish culture: fish hatchery (fish culturist) technology, which varies greatly in different areas; fish wildlife conservation technology, which deals with species not usually domesticated; and experimental biology technology, which develops methods to propagate new and useful species.

Fishery hatchery technology is the largest branch of fish culture at the present time. The technician's work consists of raising and spawning brood fish, caring for the eggs (which

involves picking dead eggs out and treating others for disease) feeding the young fish, cleaning ponds, maintaining hatchery grounds and keeping accurate records. The fish culture technician performs a function that lies somewhere between that of the laborers who are sometimes employed in hatcheries and the hatchery supintendent.

Technicians trained in fish wildlife conservation generally assist biologists in the performance of field work in fish conservation programs. They may be required to gather field data, engage in habitate improvement programs, maintain fishways and ladders and improve streams. It may require extensive travel.

In experimental biology technology, the technician assists biologists in field and laboratory work involving fishery research investigations. The work consists of sampling commercial landings of fish or shellfish for tags and other data. The experiments require meticulous care and attention to detail, and collection of unbiased and adequate data is very important.

- (2) Requirements: An adequate high school education, including as much science and mathematics as possible, is essential. English and good penmanship, along with typing ability, would be very helpful.

Since the technician's job is becoming more complex, it is advisable to enroll in a two-year college and receive an

Associate degree before attempting to land a job.

- (3) Earnings: Fish technicians can earn anywhere from \$8,000 to more than \$12,000 (mid-1970 figures). In some cases, low cost housing is available and living expenses are low.
- (4) Prospects: There is a favorable long-term outlook. With an increasing population, eventually government and private industry will have to look to the sea for food. As research increases, so do job opportunities in the field. In general, look for a slow but steady rise in jobs.

Other occupations in Group II include:

- Limnological technicians
- Chemical technicians
- Geological technicians
- Hydrographic survey technicians
- Marine Engineering technicians
- Deck support technicians
- Applied research technicians
- Oceanographic Instrumentation technicians
- Underwater technicians
- Technical writers

Detailed Examination of Some Group III Careers

(a) Fishers

- (1) Description: Commercial fishers earn their living by catching

and selling living resources from freshwater and saltwater bodies.

"Deep-sea" fishers must go out, find and catch the fish and bring them back for processing.

Crew personnel vary from three to fifteen, depending on the size of the craft. Some crew members repair fishing gear, especially nets. One acts as a cook.

Captains or experienced crew members operate navigational instruments and listen to radio reports about fishing conditions, especially how other boats are doing. They operate scan fish scopes, which give a tv-like picture of waters beneath the boats. Sometimes they must be out at sea for a number of weeks before returning.

"Inshore fishing" refers to catching or trapping salmon, crabs, shrimp, lobsters, sardines and oysters; and taking alewives, millet, spot, striped bass, shad and butterfish. They are usually out for shorter times than the deep-sea fishers.

- (2) Requirements: A person may become a crew member on their way up and possibly save enough money to get a craft of their own. Mechanical aptitude and know-how is necessary to operate machinery on modern vessels and to quickly diagnose and repair sudden breakdowns.

To get ahead as a fisher, one must have technical knowledge. They can take short courses in handling boats and related equip-

ment, meteorology, navigation, communication, marketing and biology. These courses are sometimes found in high schools in port cities, a few colleges and vocational schools.

- (3) Earnings: The range is from \$8,000 to \$50,000 depending on the job. Independent fishers are paid by poundage or volume of catch.

Workers on sea farms are paid on an hourly or monthly rate. Some fishers work for unions. Obviously, those who have their own business will do better.

- (4) Prospects: As research by fisheries scientists increases, so will the fishing industry. More and more is done with edible portions of the fish for meal, for poultry, etc. New discoveries may help correct nutritional deficiencies common in the world population. As this occurs, it will be the job of the fisher to bring the fish in. It will be a slow and steady growth and will coincide with the growth in oceanography in general. The recent extension of our protected fishing areas may increase the size of the U.S. fishing fleet. This may lead to new jobs for fishers.

(b) Merchant Marine Industry

Introduction. The merchant marine consists mainly of private firms that carry foreign and domestic commerce aboard ocean-going vessels. In 1974, 50,000 people were employed by the merchant marine industry.

- (1) Description: Occupations in the industry:

-The captain has authority and responsibility for the ships operation. He's the master.

- The deck officers (mates) are responsible to the Captain for the proper stowage of the ships cargo, the safe navigation of the ship and the maintenance of the ship outside of the Engine Room Spaces.
- Boatswains supervise deck crews and carry out the deck officer's orders.
- Able seamen steer the ship, and report slightings to the deck officer.
- Ordinary seamen do general maintenance work, such as chipping rust, painting and splicing and coiling ropes.
- Marine engineers are responsible for the operation of all the machinery.
- Oilers lubricate moving parts of mechanical equipment.
- Wipers keep the engine room clean.
- Firers-watertenders regulate the field gauges and the amount of water in the boilers.
- The ships electrician repairs and maintains electrical equipment.
- The chief steward supervises the preparation of meals.
- Cooks prepare meals.
- Utility hands carry food, prepare vegetables and wash cooking utensils.
- Mess attendants set tables, serve meals, wash dishes and care for living quarters.
- The radio officer keeps contact with the shore and other ships and maintains radio equipment.

-Pursers are ships clerks; they are responsible for the ships paperwork. They sometimes act as paramedics.

There are also deck workers, clerical operations and professional and administrative occupations.

(2) Requirements: Formal training for ships officers is conducted at State Maritime Colleges and the United States Merchant Marine Academy. Union-run technical schools train a limited number of officers and seamen each year.

(3) Earnings: The earnings vary greatly, depending on the position, from \$8,000 to more than \$20,000.

(4) Future Outlook: The maritime industry is severely depressed; Employment levels are expected to remain static throughout the 1970's. However, there are few young people in the merchant marine. More than half the people employed in this industry are over 45. Because of mandatory retirement rules, a large number of men will retire in the 1980's. Accordingly, employment opportunities will increase from 1980 onward.

Marine Careers in the New York City Area

New York, one of the largest ports in the world, has provided a large variety of opportunities for employment in marine careers. However, in recent years marine employment in the New York area has become severely depressed.

Job hunters should widen their options and be prepared to accept a second or third choice type of job or to move to other coastal areas.

Opportunities for training in the New York City area are excellent as long as you are willing to seek a job outside the New York area once the training program is over.

Those interested in a training program might contact the Pioneer Marine School located at Pier 15, East River. This is a training school in the basic marine skills. Students first take a basic course then pick an area of specialization. At the conclusion of the program the student is an apprentice in one of the speciality areas such as out-board repair or welding. The school publishes a pamphlet explaining their program. You do not need a high school diploma for admission to the school.

Those interested should contact Mr. Roger Kreutzer, Director, at 766-9056. Another School is the: Oceanic School, 365 West End Avenue, 787-2700.

For some general information you might contact: The Maritime Chamber of Commerce, 1 World Trade Center, 432-0750. The Chamber of Commerce does not do any hiring but might provide you with valuable information as to who to contact for your interest. Ask for Mr. Wieting.

Below is a list of other companies, unions, or institutions in New York City which might provide information as to marine careers, however, this list is not exhaustive and may not be nearly as helpful as contacting the Pioneer Marine School (listed above).

1. Marine Biological Laboratory of Wood's Hole

487 Park Avenue

755-4446

2. Marine Botanical Corporation

885 2nd Avenue 355-5770 (sale of seaweed)

3. Marine Carpenters, ILA, Local 901

406 West 13th Street CH3-1470

4. Marine Chemist's Inc.

1301 Hudson Street,
Hoboken, New Jersey (201) 656-7754

5. Marine Claim Service Inc.

111 John Street 267-2700

6. Marine Directory

350 Broadway 966-7700

7. Marine Engineers Beneficial Association, District #2

650 4th Avenue,
Brooklyn, N.Y. St8-0209

8. Marine Resources

375 Park Avenue 355-0017

9. National Maritime Union of America AFL-CIO

346 West 17th Street 924-3900

In pursuing a career you must have patience and be persistent!

Annotated Bibliography

Abel, Robert B. and Lindquist, Clarence B. Inner Space - Sea of Opportunity. Reprinted from American Education, U.S. Dept. of Health, Education and Welfare, Office of Education, U.S. Government Printing office, Division of Public Documents, Washington, D.C. 20402. Price: 15¢. Cat. #FS 5.256.5602. The article describes the present and future needs of oceanographers. It points out that the greatest needs in the future will be in the area of physical and meteorological oceanography. The article generally describes the requirements which will probably be placed on prospective oceanography.

Anderson, Roger and Mackin, Edward. Marine Manpower: An Initial Assessment; Marine Technology Society Journal. V. 10, no. 4; May 1976. This paper deals with where marine-related jobs are and who fills them.

Aronstein, Dr. Laurence. Oceanography: Career Education Teachers Guide (grades 8-10). Board of Cooperative Educational Services, Rockland County, New York: 1974. This guide points out some of the possible skills needed by an oceanographer with the view that as a result of experiencing some of these skills, a student may come closer to realizing what it is like to be an oceanographer. American Society for Oceanography. 1730 M. Street, N.W., Suite 413, Washington, D.C. 20036. This society will send a folder with a number of pamphlets on the subject of careers in oceanography. The pamphlets include such topics as:

1. A reading list of oceanography books divided by level into elementary, secondary and adult.
2. A list of varied institutions offering a variety of courses and degrees in oceanography.
3. Employment possibilities with private industry, universities, and the federal government.
4. Career prospects in oceanography. A realistic appraisal.
5. Other sources of information.

Boyd, Waldo T. Your Career in Oceanography. Published by Julian Messner, a division of Simon and Schuster, Inc., 1 West 39th St., New York, N.Y. 10018, 1969. This book describes the kinds of activities that a number of different kinds of oceanographers perform and in some cases deals with the pay scale and the prospects for the future.

Callaghan and Stout. Marine Career Series: Marine-Related Occupations, A Primer for High School Students. Marine Advisory Service, University of Rhode Island, April 1976. This paper indexes examples of job descriptions from scientific, professional and technical fields dealing with the marine sciences.

Chronical Guidance Reprint Service, Chronical Guidance Publication Inc. Moravia, New York, 13118; Phone 315-497-0330; (1976).

This service kit may be found in a number of libraries and what it is, is a file cabinet which contains reprints of publications on a number of careers. Each reprint provides most of the following information:

1. Work performed or job descriptions
2. Training and qualifications
3. Employment outlook
4. Earnings and working conditions

The careers mentioned for oceanography were:

1. Oceanographic Technicians
2. Oceanographer
3. Fishers
4. Fisheries Scientist

Darby, Ray, and Patricia, Conquering the Deep Sea Frontier (1971).

David McKay Company Inc, N.Y. This book describes many interesting aspects of oceanography and devotes one chapter to its careers and one chapter to listing of oceanographic institutions.

Encyclopedia of Careers and Vocational Guidance Vol II. Careers and Guidance 1975. J.G. Ferguson Publishing Company, Chicago, Ill., Doubleday & Co., Inc. This Encyclopedia lists a number of careers in oceanography and provides the following information:

1. Definition of the job
2. History
3. Nature of the work
4. Requirements and special requirements
5. Opportunities for experience and exploration
6. Methods of entering
7. Advancement
8. Employment outlook

9. Earnings
10. Working conditions
11. Social and psychological factors

Gross, M. Grant, Oceanography: A View of the Earth. Prentice Hall, Inc. Englewood Cliffs, N.J. (1972) This is a college level text which devotes one chapter to describing categories of oceanography and their applications.

Gaber, Norman H. Your Future in Oceanography. 1976, Arco Publishing Company, Inc. 219 Park Avenue South, New York, N.Y. 10003. 143 pgs. This book defines oceanography and distinguishes its many branches. The book also attempts to answer the five following questions about oceanography:

1. What are the skills, education or training required?
2. What are the opportunities?
3. What are the disadvantages?
4. What are the personal satisfactions?
5. How much can you expect to earn?

Kovalik, Vladimir and Nada, The Ocean World. Holiday House, N.Y. 1066. This book presents a general overview of oceanography throughout and devotes an entire chapter to the question of how one prepares for a career in oceanography.

Long, E. John, Opportunities in Oceanography. Published by the Smithsonian Institution for the Interagency Committee on Oceanography of the Federal Council for Science and Technology. Smithsonian Publication #4537, ICO pamphlet #8, July 1964.

This pamphlet takes a realistic look at oceanography and deals

with a number of careers in oceanography and the activities they may be involved in.

Oxenhorn, Joseph M. and Goldfeld, Burton. Oceanography and Our Future. Learning trends, a division of Globe Book Co., Inc., N.Y., Chicago, Dallas, 1975.

This book presents a general overview of oceanography and includes activities for children at the intermediate or High School level.

Ross, Frank, Jr. Jobs in Marine Science, Commercial Fishing, Marine Construction and Salvage. Lothrop, Lee and Shepard Co., N.Y. 1974.

This book introduces career possibilities in the field of marine science.

Scharff, Robert. The How and Why Book of Oceanography.

This is a book written for children of elementary school age and generally discusses oceanography, oceanographers and the methods by which they study the sea.

Stalo, Carlo J. "A Career in Oceanography." The Science Teacher, October, 1971, pp. 52-54.

This article describes the progress of oceanography careers from what was a traditional approach to a point where many types of degrees and training programs are offered in oceanography.

Occupational Handbook 1976-77 Edition. U.S. Dept. of Labor Bulletin 1975. U.S. Government Printing Office, Washington, D.C. 20402. Stock #029-001-01406-6. Catalog #L2.3: 1875.

Along with many other careers the handbook describes a number of careers in oceanography and details the following points:

1. Nature of work

2. Places of employment
3. Training, other qualifications and advancement
4. Employment outlook
5. Earnings and working conditions
6. Sources of additional information

Voss, Gilbert L. Oceanography. Golden Press, N.Y. Western Publishing Co., Inc., Racine, Wisconsin. 160 pp. paperback \$1.95.

This book surveys what the sea can be expected to yield and how it can be harvested. In doing so it describes careers in oceanography and illustrates their work.

Waters, John F. What Does an Oceanographer Do? 1970. Dodd, Mead, & Co. New York, 64 pages, \$3.23.

This book attempts to describe with illustrations the many facets of oceanography. The four basic areas described are:

1. Biological
2. Chemical
3. Physical
4. Geological

Yasso, Warren E., Oceanography: A Study of Inner Space. 1965, Holt, Rinehart and Winston, Inc.

This is a book written for the layman, high school student or undergraduate student. The book describes the potential and progress of deep sea oceanography.

FILMSTRIPS:

A Career in Oceanography. F.S. 35 mm, color, narrated on record (70 frames), 1966 Time 15 min. For secondary schools & general public. Available from Encyclopedia Britannica Films, Inc.

This filmstrip describes the work of oceanographers, the characteristics needed by an individual interested in a career in this field, including the length and type of specialized training. It gives information on various employment opportunities, working environment, and kind of oceanographic research undertaken by each discipline.

FILMS:

Careers in Oceanography. Movie 16 mm, color sound 1966. Time 28 min.

For elementary school, secondary schools and the general public.

Obtainable from Assistant for Public Affairs of your naval district when requesting refer to NN-10063 (free).

This film shows the types of research and activities that await the future oceanographer in the laboratory or aboard ship and the equipment available to assist him.

Oceanology: The Role of People. Produced by Jean-Michel Cousteau.

A production of Living Design Corporation. For elementary, junior and senior high school. 18 3/4 min. in color. Cost \$265. Rental \$21. In this film, students see a group of oceanographers learning to study the sea using very simple tools. Through a series of increasingly involved procedures, they learn that observations made by the research team could not have been done using sensing equipment alone. Using very simple equipment such as a snorkle metric square and bags of dye the researchers carry out important investigations that could not have been completed otherwise. Personal investigation gathers information essential if we are to gain a

more complete understanding of life in the ocean.

B.F.A. Educational Media

Division of CBS Inc.

2211 Michigan Avenue

Santa Monica, California 90404 .

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The Marine Biologist. (14 min.) Encyclopedia Britanica Films, Inc.

Scientist in the Sea. U.S. Navy, Assistant for Public Affairs of your naval district (when writing refer to MN-10320).

User Report Form

OCEANS CAREER UPDATE

This is a preliminary description and bibliography of marine-related careers with some emphasis on the New York area. Designed for secondary students, teachers and guidance counselors, the report is not considered to be complete. No publication or project can serve its constituency without their continuing input. Your suggestions of additional marine-related careers, texts and publications would be greatly appreciated. Credit will be given in the acknowledgement for all suggestions used. We realize this paper needs additional information on marine careers in New York City and look forward to help in this area.

Please list additional marine-related careers and your source of information on each:

Please list additional marine-related career literature and audio-visual media (where can it be rented or purchased?)

Return to: Marine Careers

Sea Grant Advisory Service
381 Park Ave., South, Rm. 621
New York, New York 10016

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